HEISENBERG'S UNCERTAINTY PRINCIPLE

Heisenberg's Uncertainty Principle in Physics states that a sub-atomic particle's position and momentum cannot be determined simultaneously. This is a seemingly boring statement, however, no other principle in Physics has had so much nonsense said about it as this one.

The trouble all started in the 18th century when Laplace and others showed by logical reasoning that because particles have a definite position and state of motion at any instant, the universe is deterministic (ie. it works by cause and effect as opposed to being random). This is not a very important fact unless you are religious — how can there be free-will if the universe is deterministic? When Heisenberg derived his Uncertainty Principle in 1927 philosophers and religionists grabbed the opportunity of exploiting this discovery to gain support for their irrational doctrines. They added an interpretation to the Uncertainty Principle stating that particles do not have definite positions and states of motion simultaneously, hence the universe is non-deterministic and free-will exists. This interpretation was supported by the Danish physicist, Niels Bohr, and is known as the 'Copenhagen' interpretation.

The Copenhagen interpretation is clearly wrong; the fact that a particle's position and state of motion cannot be determined simultaneously does not mean that it does not have these properties simultaneously. (Indeterminability does not imply non-determinism). A simple logical argument shows that any piece of matter must have a definite position and state of motion simultaneously. If pieces of matter are the same piece at a time it means that all their properties are the same at that time (including their positions), therefore the same piece of matter must have the same position at a time ie. a piece of matter has a definite position at any time. It then follows that it must have a definite state of motion at any time or else it would land up in more than one place or no place at all in the future which is impossible as it must always have a definite position. The conclusion that free-will exists if the universe is non-deterministic is also untenable. The concept of free-will is actually self-contradictory: 'free' implies non-deterministic — therefore it cannot exist in a deterministic universe, while 'will' implies a definite deterministic decision-making process — therefore it cannot exist in a non-deterministic universe either. The Copenhagen interpretation is not even consistent with the derivation of the Uncertainty Principle: the conditions for determining the position and momentum of a particle are in mutual conflict and in determining one the other is distorted.

Numerous arguments have been advanced in favour of the Copenhagen interpretation but none of them stand up to critical examination eg.

'We should not assume that sub-atomic particles have definite positions and states of motion simultaneously just because macroscopic particles have these properties.' We are not assuming anything but instead using logical reasoning about any piece of substance regardless of size.

'We should not define a sub-atomic particle as something with a definite position and state of motion simultaneously, but instead as something without these.' Why should we do this? Such a 'sub-atomic particle' would by definition not have these properties, but who says it would be the same thing as is normally called a sub-atomic particle. In fact such a particle would not be able to exist as we have shown above that its properties are impossible.

'Quantum phenomena are apparently random; this cannot be explained if the universe is deterministic.' Just because they appear random does not mean that they are really random. The result of a dice throw appears random but is deterministic as it depends on the height thrown from, air resistance and many other factors which all exist in a definite way. Because of determinism we should interpret probabilities as uncertainties and not random chances eg. If the odds against an event are 2:3 it means that the event depends on a factor which has a definite value which we do not know but which comes from a set of 5x values, 3x of which cause the event to occur.

The strongest argument in favour of the Copenhagen interpretation is that certain predictions made by the Copenhagen interpretation are correct while predictions (viz. the Bell Inequality) made by a deterministic theory are incorrect. This argument looks very convincing until one realizes that the 'Copenhagen predictions' are based only on Quantum Mechanics and not on the Copenhagen interpretation; any interpretation gives the same prediction and since Quantum Mechanics is correct the prediction is also correct. The Bell Inequality although based on a deterministic theory, is based on one which ignores Quantum Mechanics; it is not surprising that it is incorrect. In a final desperate effort the Copenhagenists argue that 'the mathematical expression for the Uncertainty Principle contains Planck's constant (h) which is a natural constant, therefore the indeterminancies in the Uncertainty Principle are due to a natural non-determinism.' The reader should be able to see for himself that this argument is nonsensical.

As a reaction to the Copenhagen interpretation the 'anti-Copenhagen' interpretation was formed. This interpretation was supported strongly by Albert Einstein. It accepts the logic that the universe is deterministic but says that the Uncertainty Principle is temporary and that one day we will be able to determine positions and momenta of particles simultaneously. This interpretation is clearly wrong as the Uncertainty Principle is not the result of temporary technological difficulties, but an underlying phenomenon. In the same way that the Copenhagenists cannot understand that indeterminability does not imply non-determinism, the anti-Copenhagenists cannot understand that determinism does not imply determinability.

A third interpretation is the 'many worlds' interpretation which was put forward by Hugh Everett III in 1957. It accepts the Principle of Determinism but says that all the possibilities in the uncertainties in the positions and momenta of particles are realized in different universes. This interpretation is also clearly wrong as it is inconsistent with the derivation of the Uncertainty Principle. There is also no explanation of where these other universes are supposed to be.

A fourth interpretation of the Uncertainty Principle attempts to extend it to macroscopic phenomena. It states that 'the observer always alters the thing he observes.' (This is an extension of the derivation of the Uncertainty Principle.) This interpretation is supported by people like Lyall Watson but is not popular among bona fide scientists. It is wrong, mainly because there are many cases where it is not true, eg. we do not alter the sun by observing its light.

While the majority of scientists insisted on giving the Uncertainty Principle fancy interpretations a few people, including myself, suggested the rationalist view of not interpreting it at all but accepting the facts as they are viz. that the universe is deterministic but we will never be able to measure positions and momenta of sub-atomic particles simultaneously. Thanks to the work of David Z. Albert and Yakir Aharonov of the University of South Carolina and Susan D'Amato of Furman University, this rationalist view became the accepted 'interpretation' of the Uncertainty Principle since 1985, the illogical philosophical interpretations finally being discarded.

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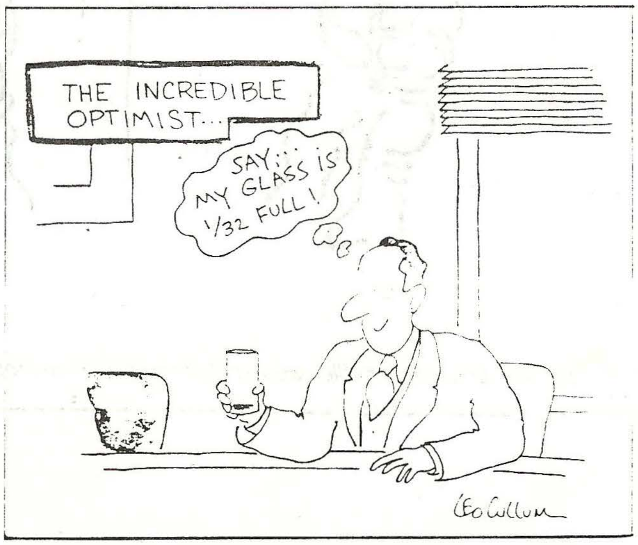
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